ROYAL ASTRONOMICAL SOCIETY.

VOL. IX. *February* 9, 1849. No. 4.

THE Annual General Meeting of the Society, Sir JOHN FREDERICK WILLIAM HERSCHEL, Bart., President, in the chair.

Before commencing the usual business of the meeting, the President rose and said:—

GENTLEMEN,—Before the proper and formal business of this meeting begins, I must call your attention to the bust which you have seen in our entrance-hall;—It is that of our late beloved and respected president, Francis Baily, a name which will never be mentioned in this Society without calling up a lively recollection of all that is excellent in public, and amiable in private, character. When you trace, as you cannot but do, in that marble the faithful and charming reproduction of features we have so often seen in the place I now occupy, animated with the pure love of science, and with deep interest in the welfare of this Society, you will be surprised to learn that it is the production of an artist by whom these features had never been seen but in the faint reflexion of an engraving from his portrait, and in that painful memento which preserves the impress of a form from which the spirit has departed. When I name the eminent artist, however, who has wrought this triumph over time and oblivion (our celebrated sculptor, Edward Hodges Baily), your surprise will cease. It is an achievement familiar to his chisel.

The bust is presented to this Society by Miss Baily, the surviving sister of our late president. She has judged rightly in supposing we shall value it. No possession we have will be more precious in our eyes. Nowhere could a memorial of the kind be more appropriately placed than in the meeting-place of a public body with which his name and his fame are so largely identified, and of which he was so distinguished an ornament. We have now his picture and his bust—both excellent. What art can do to keep his memory fresh is done. It remains for us to shew that his spirit is not extinct among us.

I am sure you will enable me to respond as I ought to do to this touching and munificent gift of Miss Baily, who has requested

me to be her spokesman on this occasion ; and as there can be but one feeling on the subject, I shall call on the Astronomer Royal to embody that feeling in a motion of thanks.

Proposed by G. B. Airy, Esq., seconded by A. De Morgan, Esq. : —

That the cordial thanks of the Society be given to Miss Baily for this valuable present.

Report of the Council to the Twenty-ninth Annual General Meeting.

In commencing this Twenty-ninth Report, the Council once more meet their constituents with congratulations on the state of the Society, and of the science which it is intended to promote. They trust that many years will elapse before either can be represented as stationary.

The Report of the auditors, subjoined, will shew the state of the finances : —

RECEIPTS.

	£	s.	d.
Balance of last year's account	131	18	9
1 year's dividend on £900 Consols	26	4	4
1 ditto on £2272 7*s*. 4*d*. New 3¼ per Cents	71	14	0
On account of arrears of contributions	61	14	0
77 contributions (1848–49)	161	14	0
2 ditto (1849–50)	4	4	0
6 compositions	126	0	0
13 admission fees	27	6	0
7 first year's contributions	11	11	0
Sale of Memoirs	69	11	0
—— Dr. Pearson's Astronomy	107	15	0
	£799	12	1

EXPENDITURE.

Mr. Barclay, for printing Testimonials				24	15	0
Ditto for printing Monthly Notices, &c.				120	11	7
Legacy Duty (Dr. Pearson's bequest)				21	11	11
Mr. Basire, engraver (do.)				14	4	0
Mr. Rumfitt, bookbinder (do.)				12	8	0
Taxes { Land tax and window duty, 4 quarters	8	7	3			
Taxes { Income and property tax, 4 quarters	1	9	2			
				9	16	5
J. Williams, for 1 year's salary as Assistant-secretary				100	0	0
Ditto commission on collecting £443 15*s*.				22	3	6
Charges on books, and carriage of parcels				3	14	7
Postage of letters and Monthly Notices				24	0	11
Porter's and charwoman's work				13	12	2
Tea, sugar, biscuits, &c. for evening meetings				13	13	0
Coals, candles, &c.				12	18	6
Sundry disbursements by the Treasurer				23	17	3
Balance in the hands of the Treasurer (25th Jan. 1849)				382	5	3
				£799	12	1

The assets and present property of the Society are as follows:

				£	*s.*	*d.*
Balance in the hands of the Treasurer				382	5	3
1 contribution of 6 years' standing			£12 12 0			
4 ———	of 5	ditto	..... 42 0 0			
1 ———	of 4	ditto	..... 8 8 0			
5 ———	of 3	ditto	..... 31 10 0			
11 ———	of 2	ditto	..... 46 4 0			
14 ———	of 1	ditto	..... 29 8 0			
				170	2	0

£900 3 per Cent Consols.
£2272 7*s.* 4*d.* New $3\frac{1}{2}$ per Cent Annuities.
Unsold Memoirs of the Society.
Various astronomical instruments, books, prints, &c.

The stock of volumes of the *Memoirs* still in the Society's possession is as follows:—

Vol.	Total.	Vol.	Total.	Vol.	Total.
I. Part 1	50	IV. Part 2	178	XI.	257
I. Part 2	95	V.	192	XII.	269
II. Part 1	113	VI.	210	XIII.	288
II. Part 2	79	VII.	236	XIV.	472
III. Part 1	140	VIII.	222	XV.	265
III. Part 2	160	IX.	231	XVI.	305
IV. Part 1	165	X.	247		

The progress and present state of the Society, with respect to Fellows and Associates, is as follows:—

	Compounders.	Annual Contributors.	Non-residents.	Patroness, and Honorary.	Total Fellows.	Associates.	Grand Total.
February 1848	121	132	72	3	328	36	364
Since elected	8	9	...	3	...	22	42
Deceased	−5	−1	−1	...	...	−1	−8
Resigned	...	−1	...	...	...	...	−1
Expelled	...	−9	...	...	...	...	−9
February 1849	124	130	71	6	331	57	388

The instruments belonging to the Society are now distributed as follows:—

The *Harrison* clock,
The *Owen* portable circle,
The *Owen* portable quadruple sextant,
The *Beaufoy* circle,
The *Beaufoy* transit,
The *Lee* circle,
The *Herschelian* 7-foot reflector,
The *Greig* universal instrument,
The *Smeaton* equatoreal,
The *Cavendish* apparatus,
The Universal quadrant by Abraham Sharp,
The 7-foot Gregorian reflecting telescope (late Mr. Shearman's),

are in the apartments of the Society.

The Brass quadrant, said to have been *Lacaille's*, is in the apartments of the Royal Society.

The Standard scale is in the charge of the Astronomer Royal, with the consent of the Council, to be employed in the formation of a new Standard Measure, under the direction of the Standard Committee.

The remaining instruments are lent, during the pleasure of the Council, to the several parties undermentioned, viz.:

The *Fuller* theodolite, to the Lords of the Admiralty.
The *Beaufoy* clock, } to the Royal Society.
The two invariable pendulums, }
The *Wollaston* telescope, to Professor Schumacher.
The Variation transit (late Mr. Shearman's), to Mr. J. Rees.
The other *Beaufoy* clock, to Mr. J. Drew.

Since the last Annual Report, the bequest of Dr. Pearson, consisting of the unsold copies of his well-known work on *Practical Astronomy*, has come into the final possession of the Society. All the complete copies, upwards of one hundred, have been disposed of, either to the Fellows or to the public, at a price fixed by the Council. The copperplates remain, together with a large number of copies of the first volume containing the tables.

Among the donations made to the Society, most especial notice must be taken of one which is presented to-day. It is a bust of our late President, Francis Baily, presented by his sister, Miss Baily, and executed by his eminent namesake, Mr. E. H. Baily, who, with the assistance of the portrait which hangs in this room, and a cast of the head taken after death, has produced a specimen of art worthy of his own fame, as well as of that of our late Presi-

dent. In returning hearty thanks to Miss Baily for this very valuable addition to our memorials of her brother, the Council feel that there is no occasion to say anything on the vital obligations which the Society owes to him, from the first day of its career to the last of his. These obligations are not such as need be recalled by an anniversary, or recapitulated on the occasion of receiving a token of consideration from his family: they are remembered in the daily routine of our business, where they will long be felt. But the needlessness of the gift in this point of view increases its value, and also our gratitude to the donor; though few words will serve to record its receipt, and to express our thanks in fitting terms.

The Council have not thought it advisable, as yet, to take any steps for the printing of the library catalogue. The heavy expenses incurred in printing matters of more immediate importance have made it prudent to postpone this one for a time; but the Council have not lost sight of it, and hope to feel able to commence the impression in a short time.

The Fellows will remember that at a Special General Meeting, held after the last Anniversary Meeting, it was referred to the Council to consider whether it would not be proper to take legal means for the recovery of the arrears due to the Society. The Council gave this subject their earliest attention; and after duly weighing the considerations on both sides, came to the conclusion, that the Society should be advised not to proceed at law, but to expel the defaulters in the usual way. This was accordingly done at a Special General Meeting, held on the 14th of April. The Council much regret that this Society, in common with others, sustains loss from the want of consideration, to say no worse, of those who are content to allow pecuniary engagements for the promotion of Astronomy to be entered into under the guarantee of the Annual Subscriptions, and leave their portion of that guarantee to be made good by others. At the same time, it is gratifying to state that this Society is high among scientific associations as to the promptitude with which its dues are paid.

The Special Meeting last alluded to had a much more pleasant duty to perform, in addition to the one above recorded. The Council proposed to it the election of three Honorary Members: His Majesty the King of Denmark, who resembles his predecessors in being a promoter of Astronomy; His Grace the Duke of Northumberland, who carried into effect with noble liberality his predecessor's engagement to print Sir John Herschel's great work on Southern Astronomy; and Baron Von Senftenberg, whose private observatory does him and his adopted country honour. It is needless to add that the Meeting unanimously adopted the proposal of the Council, and that these three worthy names are now on our list.

The intention of the Council to consider the state of the list of Associates, mentioned in the last Annual Report, led to the pro-

posal and election (on the 12th of May) of the following twenty-one gentlemen :—

Dr. P. H. L. von Boguslawski, Breslaw.
Dr. C. Bremiker, Berlin.
Dr. A. L. Busch, Königsberg.
Dr. Thomas Clausen, Dorpat.
Professor A. Colla, Parma.
M. H. D'Arrest, Berlin.
M. Daussy, Paris.
M. H. Faye, Paris.
Dr. J. F. G. Galle, Berlin.
Dr. B. Goldschmidt, Göttingen.
Professor K. Knorre, Nicolajew.
M. K. C. Hencke, Göttingen.
M. Laugier, Paris.
Professor J. H. Mädler, Dorpat.
M. Mathieu, Paris.
M. V. Mauvais, Paris.
Dr. C. A. F. Peters, Pulkowa.
Dr. A. C. Petersen, Altona.
M. K. C. Rümker, Hamburg.
M. Otto von Struve, Pulkowa.
M. Max. Weisse, Cracow.

This list, the Council can truly observe, was no indiscriminate sweep, but the result of a deliberate discussion of the astronomical claim of each and every person named. And they take some blame to themselves for remissness, in having allowed the question of additions to this list to remain undiscussed until the progress of astronomy had to be acknowledged to more than a score of distinguished cultivators. But at the same time they feel that they have some excuse in the difficulty of procuring, at the requisite time, that precise information on the labours of continental astronomers which will warrant a step that is never taken on any thing less. Since the last-mentioned period, the Council has had the pleasure of procuring from the Society the addition to the list of the name of Mr. Bond of Cambridge (U.S.), the co-discoverer, with Mr. Lassell, of the eighth satellite of *Saturn*.

Among the losses by death, the Council have to regret those of Mr. Hoyer, Mr. de Berckem, General Hodgson, Mr. T. G. Taylor, Mr. Gilby, the Marquis of Bute, and an associate, Father De Vico.

Mr. Jacob Hoyer was one of the members of the Mathematical Society. He was born in June 1797, and died February 23, 1848. Both his parents were Norwegian, and came to England a few years before his birth. At the age of about fifteen, the support of his parents devolved on him owing to his father's loss of sight, and by incessant labour he was enabled to maintain them respectably and to advance himself in life. He was an ardent lover of science, and collected a valuable library ; but an ill state of health, brought on by overwork in his youth, prevented his making any attempt to promote knowledge by his own investigations.

Henry Vincent de Berckem was born in 1804. He followed his father's profession, and passed his life on the Stock Ex-

change. He was elected a Fellow of the Mathematical Society before he was twenty-one years old, and continued a zealous member of that body until it merged in this Society in 1845. He was well versed in mathematics and in the theory of music.

John Anthony Hodgson, eldest son of George Hodgson, Esq., was born at Bishop Auckland, in the county of Durham, July 2, 1777. He received the principal part of his school education at the grammar school in the city of Durham, under Dr. Britton: and was for some time designed to follow the profession of the law. The employment, however, was found to be by no means adapted to the natural bent of his mind; and, at the expiration of his engagement, he availed himself with eagerness of an opportunity of entering the military service of the Honourable East India Company. In the year 1799, at the age of twenty-two, he embarked as a cadet for India, and in May 1800 became lieutenant in the 10th Regiment of Native Infantry.

Until this time his attention had not been directed either to the Oriental languages or to general science. But he now devoted himself with assiduity to those studies, and especially to practical astronomy.

The earliest of his observations (an immersion of *Jupiter's* first satellite, October 23, 1812, observed at Setapoor cantonments, Oude) is printed in *Mem. Hist. Soc.* vol. ii. p. 344.

In the year 1817, being then captain in the 10th Regiment, B. N. I., he was selected with Lieutenant Herbert to conduct a survey of the sources of the rivers Ganges and Jumna, and to determine the heights and positions of the principal peaks of the Himalayan mountains.*

In conducting this survey great difficulties were encountered, both from the deficiency of those means which are usually considered essential, and from peculiar physical obstacles. The instruments were exposed to all the casualties of a long voyage, a long journey, and much rough usage. Hence the barometers and thermometers were frequently found broken on their arrival at their destination, and not unfrequently, before a barometrical measurement could be made, it was necessary to fill the tube.

The progress of the survey was much retarded by natural impediments. For some time the operations were suspended after the early period of every day, in consequence of avalanches of snow and rock being hurled into the valley as the heat of the sun melted the snow; and a passage was often to be forced through many obstacles, and along the face of precipitous rocks.

There was, especially, one occurrence so different from those which usually cross the calm path of scientific investigation that it deserves especial notice.

It is thus recorded in the Journal of May 26, 1817.†

* Asiatic Researches, vol. xiv. pp. 60, 153, 187.

† Asiat. Trans. vol. xiv. p. 97.

"The path to-day was of the worst description, and is on the whole, I think, the most rugged march we have hitherto had, though there are not any long ascents. Nothing can be more unpleasant than the passage along the rotten ladders and inclined scaffolds by which the faces and corners of the precipice near Bhairog'hátí are made. The rest of the way lies along the side of a very steep mountain, and is strewed with rocks. The ruins of the snowy peaks, which are on all sides, were very grand and wild . . . . . Too much tired to attempt to boil mercury in the tubes to-day. At night, having prepared the instruments to take the immersion of one of *Jupiter's* satellites, we lay down to rest, but between ten and eleven o'clock were awakened by the rocking of the ground; and on running out saw the effects of an earthquake, and the dreadful situation in which we were pitched, in the midst of masses of rock, some of them more than a hundred feet in diameter, which had fallen from the cliffs above us, and probably brought down by some former earthquake.

"The scene around was shewn in all its dangers by the bright moonlight, and was, indeed, very awful. On the second shock, rocks were hurled in every direction from the peaks around to the bed of the river, with a hideous noise not to be described, and never to be forgotten. After the crash caused by the falls near us had ceased, we could still hear the terrible sounds of heavy falls in the more distant recesses of the mountain.

"We looked up with dismay at the cliffs overhead, expecting that the next shock would detach some ruins from them. Had they fallen we could not have escaped, as the fragments from the summit would have flown over our heads, and we should have been buried by those in the middle. Providentially there were no more shocks that night.

"In the morning we removed to the left bank of the river . . . We had the curiosity to measure trigonometrically the height of the cliff at the foot of which we were during the shock, and found it to be 2745 feet."

The height of the station above the level of the sea appeared by barometric measurement to be about 10,300 feet.

Notwithstanding these and other natural obstacles, the enterprising travellers persevered, and on the 31st of May, 1817, reached the point where the Ganges first issues from beneath a vast bed of snow, surrounded by gigantic peaks, in latitude 30° 56′ 6″ north, a spot to which there is no record that any person before had penetrated.*

The operations for the survey of the peaks of the Himalayan range were carried on upon a vast scale. One of the principal stations was at an elevation of 12,000 feet, in the region of perpetual snow: the distances of some of the peaks from the stations at which they were observed exceeded 150 miles; and above twenty of those peaks attain an elevation between 20,000 and 27,000 feet, including the loftiest known mountain in the world.

* Asiatic Trans. vol. xiv. pp. 118, 171.

The results of these labours have become well known. Four sheets of the Atlas of India were made from his trigonometrical surveys, and under his immediate superintendence.

In the great geographical work of Ritter, General Hodgson's authority is appealed to as definitively fixing the positions which he surveyed.

The principal characteristic which marks General Hodgson's surveys is his perseverance under difficulties of no ordinary kind, and his great fertility of resource. His astronomical and geodetical observations were made with a delicacy and accuracy which will fully bear a comparison with those executed under far more favourable circumstances; and in every emergency he availed himself of all the means suggested by sound philosophy and practical common sense.

There is a series of transit observations* made under his superintendence at Calcutta, and a series of magnetic observations† made by him at the same place.

In May 1821, General Hodgson was appointed Surveyor-general of India, but not confirmed. In 1826 he was again appointed, and held that office till 1827, when he returned to England.

On his return to Europe, he resided for some time in the city of Durham; and in June 1842, in consideration of his distinguished character as a man of science, he was admitted to the honorary degree of M.A. in the University of Durham.

In 1845, having then the rank of Major-general, and being Colonel of the 14th Regiment of Bengal Native Infantry, he was appointed to the command of the district of Rohilcund, and died at Umballah on the 28th of March, 1848, in the 71st year of his age.

The following papers by Major-General Hodgson have been published in the *Memoirs* of this Society.

Vol. II. Observations of *Jupiter's* Satellites, made at Chouringhy.
Observations of ditto, made at Futty Ghur, on the Ganges.

Vol. III. Observations at Calcutta, comprehending, 1. Transit of *Mercury*, Nov. 4, 1822. 2. Occultations of Stars, March and April, 1823.

On the Mode adopted for determining the Time of the Observations of *Jupiter's* Satellites at Futty Ghur.

Register of certain Observations of the Eclipses of the Satellites of *Jupiter* made in Hindostan and in the Burmese dominions, between July 18, 1795, and April 11, 1827.

Observations of Transits of the Moon's Limb and certain Stars, from Nov. 18, 1826, to March 20, 1827, at Calcutta.

* Astr. Soc. Trans. vol. iii. part ii. p. 358.
† Asiatic Researches, vol. xviii. part ii. p. 1.

Thomas Glanville Taylor, late Astronomer to the Honourable East India Company at Madras, was born at Ashburton, Devonshire, November 22d, 1804, about a year before his father, Thomas Taylor, was appointed assistant to Dr. Maskelyne at the Royal Observatory. He remained at school until he was fourteen, when his father (who had previously intended to bring him up as a surgeon) was induced, on Mr. Pond's suggestion, to devote him to astronomy. About the beginning of 1820 he was engaged as a supernumerary at the Royal Observatory, and was placed on the establishment as a regular member in August 1822, when the number of assistants (by Mr. Pond's exertions) was permanently increased to four. Mr. Taylor's principal duty was to take charge of the transit observations at night.

Soon after this time he computed the orbit of a comet, as well as we recollect, by La Place's method ; but we are unable to supply the exact date, or to refer to the proper authority.

Mr. Taylor gave every aid in his power to Colonel, then Captain, Sabine, when he was engaged on "*his experiments for determining the difference in the number of vibrations, made by an invariable pendulum, at the Royal Observatory at Greenwich, and at* Mr. Browne's *house in Portland-place, where* Captain Kater's *experiments were made.*" This assistance is apparent throughout the memoir, and was very handsomely acknowledged by Colonel Sabine (*Phil. Trans.* 1829, p. 85). When the same accomplished observer was engaged on his still more difficult and delicate investigation, respecting "*the reduction to a vacuum of the vibrations of an invariable pendulum*," (*Phil. Trans.* 1829, p. 207) he again acknowledged, in fitting terms, "the valuable assistance of Mr. Taylor," who, besides furnishing the clock rate and error, observed a considerable number of sets in the pendulum series. We need not ask for a higher testimony to Mr. Taylor's skill and powers of manipulation in the nicest operations.

About this time he was engaged, at his leisure hours, in assisting Mr. Groombridge with the reduction of his *Catalogue of Stars within* 50° *of the North Pole ;* and though only a small portion of this task was accomplished by him, the duty was faithfully and efficiently discharged.

The zeal and ability of Mr. Taylor was so well approved to Mr. Pond, then Astronomer Royal, that he recommended him to the Honourable East India Company as a proper person for the important office of Director of the Company's Observatory at Madras. Mr. Taylor was accordingly appointed in the spring of 1830 : his astronomical observations have since that time been regularly published at the expense of the Company, and extend at present to five volumes.

In 1840 Mr. Taylor visited England, and returned to Madras in the following year. Two or three years afterwards he met with a severe accident while on a visit to the observatory of Trevandrum—a fall, occasioned by his extreme shortness of sight—from which he never perfectly recovered. His own failing health, and

the anxiety he felt with respect to his daughter's illness, who was then in England, brought him back to his native country. He arrived on the 4th of April last, in time to receive the last breath of his child, who expired next day. He still entertained sanguine hopes of his own recovery, and spoke with cheerfulness and interest of the publication of his last volume of Observations, but his weakness and extreme emaciation continued to increase, and ended his life on May 4, 1848. He has left a widow and three sons.

Besides the Madras *Astronomical* Observations, Mr. Taylor made a very extensive series of *Meteorological* and *Magnetic* Observations, and also directed and superintended other similar observations in different parts of India, most of which have been published by the Company. Though these works have been liberally distributed by the Honourable Company to all proper applicants, they are probably less known than they deserve to be, from want of sufficient notoriety. Mr. Baily made the Madras catalogues of fixed stars the basis of his great catalogue, which is commonly known as the Catalogue of the British Association, and devoted a column in that work to Mr. Taylor's nomenclature. We do not know whether any attempt has been made to appreciate the exactness of the determinations; but the observations are so numerous, and the list of stars so extensive, that such a research would appear feasible enough, and the result of great practical utility. For many stars Mr. Taylor's authority is probably the best, but some measure of the probability of his errors is very desirable.

A memoir on the longitude of Madras, derived by Mr. Taylor from a comparison of his transits of the moon with those taken at Greenwich, Cambridge, &c., will be found in vol. xvi. of the Society's *Memoirs*. This is a supplement of a former memoir, vol. xii.. on the same subject, from data of the same kind, by Mr. Riddle. The longitude of Madras is of great importance in geography and navigation, as its meridian is a secondary meridian for India and for the Eastern Seas. There is also in vol. x. a short paper by Mr. Taylor on the right ascensions and declinations of Halley's Comet, near the time of opposition in 1836, from observations made at Madras.

It is understood that the Observatory at Madras, while under Mr. Taylor's direction, rendered efficient assistance to the vessels which touch at that important point. On one occasion, at least, he gave timely notice of a coming storm (from meteorological indications), which saved much shipping from imminent danger. Nowhere can such aids be more required than at Madras.

The Society has lost in Mr. Taylor a zealous practical astronomer, and a sincere friend to the body.

The Rev. William Robinson Gilby, son of John Gilby, Esq., of Winterton, Lincolnshire, was born in 1789. After remaining for several years at Shrewsbury School, then taught by the celebrated Dr. S. Butler (afterwards Bishop of Lichfield), he was admitted a

pensioner of Trinity College, Cambridge, in 1805. His university course was very successful. He was elected scholar in his freshman's year, 1806; was in the first class at each annual examination, took the degree of seventh wrangler in 1809, and was elected fellow in 1811.

For a few years he studied the law with assiduity, and gave promise of great eminence in that profession; but his health failed, and he entered the church about 1819. He married in 1820, and in 1823 was appointed by Lord Chancellor Eldon to the living of St. Mary with St. Nicholas in Beverley. In 1832 he resigned this living, and made a tour on the Continent. Soon after his return home he built a small observatory, which he furnished with a very beautiful altitude and azimuth circle by Troughton and Simms, the altitude circle being 2 feet in diameter and originally divided. Collimating telescopes with spirit-levels were applied, perhaps for the first time in England, to this instrument, as an additional mode of adjustment. A transit-clock by Dent, and chronometer, &c. completed the equipment.

Mr. Gilby paid a good deal of attention to observing, and corresponded with one of our fellows on the subject of certain instrumental reductions; but we are not acquainted with the particulars of his researches. It was, perhaps, imprudent, in a man so delicate, and who was also greatly occupied by his magisterial duties, to undertake such a troublesome instrument,—one which, so far as we remember, has proved almost unfruitful in every amateur's hands, except in those of Mr. Pond. It is most likely that, when he had mastered the instrument, he found the pursuit too laborious and the night exposure too great. This was to be lamented, for as Mr. Gilby was a good mathematician, and very energetic in all his undertakings, he would have done good service in a lighter department of astronomy, while he would have exposed his health less.

In the latter years of his life, Mr. Gilby's health was such as to prevent much active employment. A slight imprudence, in exposing himself to a damp day, brought on an attack from which he never rallied; after a few days' illness, he died on February 23d of last year.

John Crichton Stuart, second Marquis of Bute, died most suddenly at his seat, Cardiff Castle, on the 18th of March, 1848, after having entertained a party of friends at dinner. He was born on the 10th of August, 1793, and was consequently in the fifty-fifth year of his age, twenty-one of which he had been a member of this Society. In 1803, by the death of his maternal grandfather, he succeeded to the earldom of Dumfries; and in 1814, by that of his paternal grandfather, the first Marquis of Bute, he inherited that dignity.

Lord Bute, though afflicted with a defective vision, was of very active, business-like habits, and performed his several duties with great diligence, and mostly judicious conduct. His greatest undertaking was the construction of the grand floating docks at

Cardiff, a vast harbour, which affords the most ample accommodation for hundreds of ships to avail themselves of the mineral riches of Glamorgan at all times and seasons. The Marquis expended at least 400,000*l.* upon this important work; and his munificence has not only already enriched the town, but must, inevitably, from the fitness of the site and capacity of the float, fully repay its costs with interest in the end. The full energies of the project have certainly been procrastinated by litigation and impolitic measures, but the plan and object are too useful to be long repressed.

Francis De Vico belonged to the noble Italian family of that name, and was born at Macerata in the march of Ancona on the 19th of May, 1805.

He was educated at the college of Urbino, and although the eldest son, with brilliant prospects of advancement in the world, he evinced such a decided inclination for a religious life that he was admitted a member of the Society of Jesus in December 1823.

He distinguished himself in his theological studies, and having also shewn a peculiar aptitude for astronomical science was associated with Signor Dumouchel, the then Director of the Observatory of the Collegio Romano.

On the death of Signor Dumouchel, in 1839, Professor De Vico succeeded him as Director of the Observatory.

De Vico was for some time a professor of the higher mathematics in the Roman college, and afterwards became the astronomical professor, in which distinguished situation he continued for many years.

Being ever indefatigable in the pursuit and advancement of astronomical science, besides the two members of the order who were his regular assistants in the observatory, he associated as aids in his astronomical labours several young men of marked talent whom he had previously instructed for that purpose under his immediate direction.

Professor De Vico wrote and published numerous memoirs upon astronomy and other branches of physical science, many of which are highly esteemed. His observations of the Spots of *Venus*, and of the Rotation of that planet, and his observations of the Rings of *Saturn*, are well known to astronomers, and much admired.

He had the honour of discovering six comets:—

The	First	on	August 22, 1844.
,,	Second	,,	Feb. 26, 1845.
,,	Third	,,	Jan. 24, 1846.
,,	Fourth	,,	Feb. 20, 1846.
,,	Fifth	,,	July 29, 1846.
,,	Sixth	,,	Sept. 23, 1846.

These discoveries following each other so closely, and made at a period when many astronomers of practised ability were devoting

much attention to cometary phenomena, added considerably to the already well-deserved fame of De Vico.

The King of Denmark's Gold Medal, granted to the first discoverer of a telescopic comet, was awarded to him four times in 1846 for the comets he discovered in that year.

He also obtained the prize of Lalande, which is awarded every year by the French Academy of Sciences, on Lalande's foundation, "to the maker of the most interesting observation, or the author of the memoir which has most advanced astronomy." De Vico was one of the forty members of the Italian Society of Science.

He possessed considerable talent in musical composition, especially in sacred music, and he found leisure, amidst his astronomical labours to form and direct a body of singers for the Papal chapel which gained the admiration of connoisseurs in that art.

When the Society of Jesus was sent away from Rome in 1848, it was the universal desire of the city, including even the adversaries of the Jesuits, that Professor De Vico should remain as Director of the Observatory, but he would not consent to this, and departed secretly from Rome.

He then visited Paris, and came to England in the summer of 1848, when his talents and agreeable, unassuming manners gained him many friends among men of science.

From England he proceeded to the United States of America, in furtherance of some scientific labours. He soon returned to England, and shortly afterwards was attacked with typhus fever, brought on by fatigue and anxiety of mind, of which he died on the 15th of November, 1848. He is interred in the cemetery at Chelsea belonging to the Roman Catholic chapel.

The *Monthly Notices* have now been before the Fellows of the Society long enough to shew the design and effect of the alterations mentioned in the Annual Report of last year. It is evident that their contents are larger and more varied, and, therefore, that the Fellows receive a somewhat better return for their contributions. Probably the expense will not *much* exceed that under the former arrangement; but it must not be concealed that the printing and postage of the *Monthly Notices* form one of the heaviest items in our yearly expenses. On the other hand, it is certain that the ephemerides which are contained in the *Notices*, and the excellent observations thereby obtained, have been very useful to astronomy and very creditable to our self-supporting Society.

For the ephemerides, the Society is indebted to Messrs. Adams, Graham, Hind, and Pogson, and also to our excellent friend and associate, Professor Schumacher, the active promoter of all astronomical inquiry. The observations, in general, are transmitted in so clear a form that they can be handed at once to the printer; those, for instance, from Cambridge, Markree, Liverpool, &c. may be taken as models. In some cases, a little more care and a little attention to the forms now established in the *Monthly Notices*,

would save a good deal of unnecessary trouble. It is also very desirable that when there is any peculiarity in the instrument or mode of observing, this should be very fully explained; an oversight in this respect is not uncommon, even in practised observers, it is so easy to suppose that to be known to another which is before your own eyes. If the vexation which a little carelessness in this respect gives were fully appreciated, there would soon be no cause for complaint, and some time and expense would be saved.

A short account of the course pursued by the Council with respect to the *Memoirs* presented to the Society may be satisfactory. All those papers which are deemed by the Editor of the *Monthly Notices* to belong to his department are printed as soon as possible, without waiting for their announcement to the Council. The heavier papers are announced to the Council, and read at the evening meetings; an abstract is published as soon as it can be furnished. In the *Monthly Notices* there is no attempt made to alter or correct the *sense* of any communication; if it is tolerably ingenious, and not positively absurd, the substance is printed in the author's words, compressing the language as much as possible, and striking out what seems irrelevant. If a paper appears unworthy of attention (and the Society receives two or three such every session) the nature of the contents is briefly reported to the Council, and a Committee is appointed, to whose judgment the paper is referred. In all cases, the papers, whether printed in the *Monthly Notices* or not, are referred to a Committee to decide whether they shall be printed in the quarto *Memoirs*, and a ballot is taken by the Council upon the report of the Committee. When a paper consists of observations or ephemerides, it is referred (with all papers of a similar kind) to an observation committee, who hold their meetings at the end of the session. In this way it is hoped that every communication is carefully examined, and that the Society receives the whole of the useful information presented to it, either in the 4to. or the 8vo. publication. The lucubrations of those authors who treat every science, unknown to themselves, as a new science, and who conceive that astronomy is yet to be *discovered*, or rather *guessed*, without geometry, or analysis, or dynamics, are either deposited peacefully in the archives, or returned to their writers at the discretion of the Secretary.

About eight sheets of the seventeenth volume of the quarto *Memoirs* are printed, and it is hoped that the whole will be completed in a few days.

Another small planet has been added to our list during the past year. It was discovered on the 26th of April, by Mr. A. Graham, Director of Mr. Cooper's Observatory, Markree Castle. A rigorous search for planets had been commenced some time previous, and is still pursued agreeably to a plan which has been already described in the *Monthly Notices*, and which we may reasonably hope will lead to the detection of other planetary bodies. This new member of the system has received the name *Metis*, with

an eye and star for a symbol. The period of revolution is 1346 days, or almost identical with that of *Iris*. The planet was never brighter than a star of the 9-10th magnitude, and, towards the end of its first appearance, was very much fainter. It was followed, at Cambridge and Berlin, until the commencement of August. Mr. Graham has calculated an ephemeris for the approaching reappearance, which, however, takes place under somewhat unfavourable circumstances. *Metis* approaches very closely to the orbits of the planets *Vesta* and *Flora*.

A remarkable discovery, that of an additional satellite of *Saturn*, was made last year, almost at the same moment, by Mr. Lassell, at Liverpool, and our associate, Mr. W. C. Bond, of Cambridge, U.S. Full accounts by the respective authors will be found in the *Monthly Notices*, and the peculiarity of the discovery is considered by the President in his speech.

Since the last Anniversary of the Society two new Comets have been discovered, both at Altona, and the celebrated Comet of Encke has reappeared.

On the night of August 7th, Dr. Petersen, assistant astronomer to our distinguished Associate, Professor Schumacher, detected a telescopic comet in *Auriga*, which was observed pretty generally until the 25th of the same month. It was at no time visible to the naked eye. Parabolic elements represent the observations within their probable errors. The inclination of the orbit to the ecliptic exceeds 85°.

The second new comet was found by the same astronomer on the evening of October 26th, in the constellation *Draco*. It was then tolerably bright, with a strong condensation resembling a stellar nucleus near the centre of the nebulosity. Shortly before its disappearance beneath our horizon, in the middle of January, it was visible without the telescope, exhibiting a short tail and presenting the appearance of a hazy star of the fourth or fifth magnitude. M. d'Arrest has calculated the elements from a wide extent of observation, but finds no indication of ellipticity. As in the case of the first comet, the orbit is very highly inclined to the plane of the ecliptic: at the descending node, which occurred three weeks before the perihelion passage, the comet approached our orbit within 0·025 of the earth's mean distance. It will be still visible to astronomers in the southern hemisphere for some time.

The reappearance of the Periodical Comet of Encke was detected on the 27th of August, by Professor W. C. Bond, of Cambridge, United States, with the great refracting telescope recently erected at that place. Professor Challis saw it on the 2d of September; on the following night it was found at Mr. Bishop's Observatory; and on the 4th at Berlin, by Dr. Galle. The comet was generally observed during the month of October, and Professor Bond was fortunate enough to obtain observations after the perihelion

passage and close approach to the planet *Mercury*. It presented much the same appearance as in 1828 and 1838, the general outline of the comet being elliptical, with a very sensible condensation of light on the side near the sun.

The late transit of *Mercury* was very extensively observed. At the Royal Observatory it was observed with eight telescopes, three of which were employed in the method of casting an image of the sun upon a screen of white paper. Allusion is made to these observations only for the sake of recording one singular discordance. At seven of the telescopes the planet was seen to enter upon the sun's limb without any distortion; at the eighth, in which the image was thrown upon a screen, the planet was much distorted at entrance, its limb being for some time connected with the sun's limb by several black ropes, similar to those which have been remarked in transits of *Venus* and eclipses of the sun. This was seen by several observers. It is to be remarked, that this telescope (the Sheepshanks telescope of the south-east equatoreal) is the largest, and, upon the whole, the best that was used, and that the image of the sun was the brightest; but that it was disturbed much more by atmospheric undulation than the image formed by any of the other telescopes. It would seem possible that this strange phenomenon may have some connexion with the same irregular refraction which produces the notched and serrated appearance of the sun's limb.

In the Report of last year, allusion was made to a proposed change in the meridional instruments of the Royal Observatory. The change specified (the substitution of a transit-circle, with a telescope of 8 inches aperture, for the transit instrument and mural circle) having received the approval of the Board of Visitors and the sanction of the Board of Admiralty, is now in progress. Jones's Cape circle, having been made as efficient for observation as its faulty division permits, was used for a time, while Troughton's circle was shifted to an eastern wall of a building, where a temporary shed was erected over it, and where it is still in use. The circle-room was entirely taken down, the stone-piers were removed, and (the preliminary steps having been taken while the pier was in its ancient position) one of them was bored with the holes necessary for the arrangement of microscopes and illuminators proposed by the Astronomer Royal. The piers were then built up in their new positions, and the new transit-circle room was built over them. It has been necessary to extend the room to a length of 35 feet in the meridional direction; and this consideration alone made it almost imperative to adopt a construction which the Astronomer Royal had found convenient to adopt in smaller observatories, namely, to place the roof with its ridge north and south, and with the observation-opening along the ridge and in the end-walls. These preparations are very nearly completed. In the mean time the preparation of the instrument (the massive parts of which are

entirely of cast-iron) has been advancing under the anxious superintendence of Mr. C. May (of the firm of Ransomes and May, engineers, of Ipswich). The axis, including the central cube and the pivots, is formed in two pieces only, the pivots being made hard by a process well known to ironfounders called *chilling*, a process which (in this case) secures the inestimable advantage of forming the pivot in the same flow of metal as the rest of the axis, while its surface is as hard as hardened steel. The casting of these halves of the axis (a very complicated piece of work) has been successfully accomplished, and they are now to undergo the operations of planing, turning, and (for the pivots) grinding, by an operation which gives the same certainty of circularity as the ordinary process of turning. Within the axis will be fixed a collimating telescope (to be viewed, when necessary, by an external telescope), by which any error in the form of the pivots will be detected and measured. The end of the telescope has been cast, and, such is the skill of the founders, its weight scarcely exceeds that of a tube of stout sheet-iron. The circle is in preparation. The microscope-holes through the pier are so placed in the surface of an imaginary cone, that, though the microscopes will read the divisions on a circle 6 feet in diameter, the eye-holes will be in a circle of only 2 feet in diameter (an arrangement which will very much diminish the labour of the assistants). The illuminating-holes are so placed in the surface of another imaginary cone that one lamp will illuminate the divisions under all the microscopes, without any intermediate reflector. As the axis of each illuminator is necessarily inclined to that of its corresponding microscope, it is necessary that the surface of the divided limb be so inclined that the rays of light passing down the illuminating-hole may be reflected by it up the microscope, and therefore the circle must be *dished*. Arrangements for effecting this object are made by Mr. May. The form of the instrument will not admit of reversion or of the application of a level in the ordinary way, and it has become necessary to determine the error of collimation by two fixed collimators, admitting of adjustment on each other (a plan which also gives the great advantage of perpetual reference to two meridian marks), and to determine the error of level by observation of the wires by reflexion, or by the observation of transits of stars by reflexion. In these, and some other points, several novelties have been introduced, but not one has been introduced except where the magnitude of the instrument, or constructions required in the first instance by its magnitude, imperatively demanded it. In this respect, perhaps, the plan of the instrument may be interesting to the members of the Society, as shewing the direction which probably will be taken by the changes in the construction of instruments, arising from the increased magnitude which we may expect to attend the already increased facilities for procuring large object-glasses. A model of the instrument, shewing the form originally proposed for it by the Astronomer Royal, and from which, in fact, no deviation whatever has been made (except in some trifling dimensions, not affecting the

principle of any part), as soon as it has ceased to guide the workmen will be placed by the Astronomer Royal at the service of the Royal Astronomical Society, if they deem it worthy of their acceptance.

The Society have already been acquainted with the general fact that an altitude and azimuth instrument, of remarkably massive and firm construction, has been mounted at the Royal Observatory, for the express purpose of observing the moon on every day on which it is at any time visible. We cannot but consider this as the most important innovation that has been introduced at the Royal Observatory for many years, whether we remark in it the recognition of the one object for which the Observatory was originally built as that which ought still to be considered its principal object, or whether we consider the principles of firmness and absence of adjustment on which the instrument itself is constructed. In regard to the increase in the observations, it may be generally stated that the number of days of observation has been nearly doubled, and that numerous observations are now made on a full quadrant of the moon's orbit in which it was impossible to observe her before. In regard to the instrument itself, there have been the usual difficulties attending every new construction. At first the observations were somewhat deranged by the use of too heavy counterpoises for the horizontal axis; at a later time the derangements of the levels were so serious as to shew that the English construction of levels must be abandoned, and that the modern German construction (in which the glass tube is supported in Y's without plaster or any other fixing substance) must be substituted. This change was not made in all the levels, but in those which had, by their discordance, given the greatest trouble; and it is worthy of remark, that these levels are now the steadiest of all. It is much to be wished that English instrument-makers should adopt this construction generally, or, at least, in all cases in which levels are permanently attached to instruments. After this, a cause of vexation was discovered, to which nothing analogous (so far as we know) has ever been remarked. The existence of personal equation in the observation of transits has long been known. It has lately attracted much greater attention than it formerly did, and, for some years past, the examination into the personal equations of the several assistants has formed an important part of the introduction to each of the annual volumes of Greenwich Observations. But the fact now discovered, and established on most certain evidence, is, that the personal equation is not the same for the moon and for stars, the difference amounting to nearly four-tenths of a second of time, and that in the instance of the assistant whose observation is believed to be anomalous, the moon is observed (with reference to the stars) too early by this quantity. The error affects equally the first limb and the second limb of the moon, so that the diameter of the moon is not affected. On applying a correction for this, the results of the observations are made as accordant as those of meridional observations; and the Astronomer Royal considers that the difficult practical problem which he had proposed to himself, of making

extrameridional observations as accurate as meridional observations, is completely solved. Lately a new circumstance has attracted attention. The relation of the azimuth-zeros determined by high and low stars, and the relation of the errors of tabular zenith distances on the east and on the west sides of the meridian, agree in indicating that the arc of longitude between the altitude and azimuth instrument and the transit instrument differs from the geodetic arc by one-tenth of a second of time. In order to verify this very curious circumstance (which may, in fact, arise merely from an error of personal equation), and to give greater accuracy to the observations generally, the internal arrangements of the observatory have been completely remodelled, in such a manner that the personal equations of the observers who are employed in turn on the altitude and azimuth instrument may be accurately determined by continual interchange of observations with the transit instrument.

The 25-feet zenith tube of the Royal Observatory, having been found to give results of no greater accuracy than those obtained in the ordinary course of observations with the mural circles, and having been the cause of much inconvenience, from its local position and other circumstances connected with its observations, has at length been dismounted. Allusion has been made, in former communications to the Society, to a singular construction proposed by the Astronomer Royal, in which the micrometer will be carried by the frame of the object-glass, and a trough of mercury will be placed at a distance below it equal to half the focal length of the object-glass. The incessant work of preparation of new instruments, and other occupations at the Royal Observatory for some time past, have prevented the taking of any steps for the mounting of the new zenith sector; but it is now in the hands of Mr. Simms, and will probably be in action in a short time.

In the last Report of the Council, an ample account was given of the Reductions of the Greenwich Lunar Observations from 1750 to 1830, then nearly prepared for publication. Since that time the work has been published in two quarto volumes; and the Council are confident that it may be exhibited to the world as one which for magnitude (as directed to a special object) and for general accuracy has scarcely ever been equalled. Already this work is beginning to produce its fruits. The volume of our *Memoirs* now in the press contains a communication by the Astronomer Royal, exhibiting the principal deductions from those reduced observations, as applying to the mean motions of the moon and of the various arguments on which her inequalities depend, and to some of the coefficients of the largest inequalities, either those which must in the nature of things be deduced from observation only, or those which ought to be correctly computed by mathematical process on the pure theory of gravitation. It is shewn upon most certain evidence that several of these require sensible correction. It is also shewn (apparently beyond doubt) that a term must be introduced into the moon's latitude, and possibly some terms into the moon's longitude, of a

form whose existence has hitherto been actually denied by theory. Every apparent contradiction which the theory of gravitation has hitherto received has served ultimately to confirm that theory; and it is probable that the terms to which we allude here, though discovered purely from observation, may yet be shewn to be a legitimate and necessary consequence of theory. The astronomical antiquarian and speculator on the construction of astronomical instruments may perhaps find some worthy food for reflection in the remarks made by the Astronomer Royal on the desertion of the correct principles of instrumental construction by the most celebrated instrument-makers of the last century, and on the uncertainty even of the most important geographical element in the position of the observatory as determined from the observations made at that time.

The Astronomer Royal has for some time past been occupied with the preparation of a catalogue of stars from all the observations made at the Royal Observatory, from the beginning of 1836 to the end of 1847. In this catalogue the places of the stars are exhibited for two epochs, namely for 1840 and 1845. The reason for this separation is, that the increasing attention to the proper motions of stars forbids us to include in one group all the observations extending over a period so long as twelve years; at the same time that the frequent absence of determination of one element in one catalogue, while it is supplied in the other, makes it desirable that the two catalogues should be placed in juxtaposition. This catalogue would long since have been placed before the Society, but that the Astronomer Royal has thought it very desirable to take this opportunity of giving facilities for the introduction of his new method of correcting the places of stars, described in a communication to this Society. It has been necessary for this purpose to compute ten constants for every star. It was also necessary to compute day-constants for a considerable time. The Superintendent of the *Nautical Almanac* having, at the request of the Astronomer Royal, most liberally computed and furnished to him the necessary preliminary numbers to the end of the year 1860, the day-numbers peculiar to this method have been computed and will be printed, for every day from the beginning of 1849 to the end of 1860. The whole of the work is now finished, and a large portion of it is in the printer's hands.

The observations at the Cambridge Observatory have been carried on with spirit, though the attention which university duties demand from Professor Challis is so much taken from those of its director. As senior resident member of the newly-established Board of Mathematical Studies, and a professor actually engaged in lecturing, Professor Challis has reason to fear that he will be obliged to abandon a part of what he has hitherto undertaken. The observations of the sun, moon, and other planets, were discontinued at the beginning of last year. The new planets have been observed, when practicable, on the meridian, and at other

times with the Northumberland Equatoreal. The volume of *Observations* for 1843 is published. Its Appendices contain so many of the observations made in search of the planet *Neptune* as are required to substantiate the special Report made to the Senate in December 1846, and also the Astronomer Royal's description of the Northumberland Equatoreal and Dome.

The ninth volume of the *Oxford Observations* will be published in a short time, and it is to be hoped that no unnecessary delay may take place in the publication of the catalogue of circumpolar stars on which Mr. Johnson has been so long engaged. Astronomy can scarcely receive a more valuable acquisition, and if more aid is required for the laborious reductions, we doubt not that it will be readily granted by the Radcliffe trustees.

The long-delayed heliometer has arrived safely at the Observatory; but many months must elapse before it can be mounted, as the building in which it is to stand is not yet commenced. The instrument is of the largest class; its divided object-glass is $7\frac{1}{2}$ inches in diameter, and of 10 foot focal length. The mounting is equatoreal, on a plan of Repsold, the constructor. By some departures from the ordinary German method, the right ascension and declination circles are 3 feet in diameter. There are also many modifications, hereafter to be described, in the structure of the instrument in its strictly heliocentric capacity. From such an instrument, in Mr. Johnson's hands, the Council feel justified in expecting future announcements of the greatest interest and value.

The repairs of the Edinburgh Observatory have been completed in a very efficient and satisfactory manner by the Government, who have further carried out the terms of the transfer of the property, by appointing a Board of Visitors to make an annual report on the manner in which the business of the Observatory has been carried on during the last year.

The Board is composed of five official members, connected with the various educational and scientific establishments of Edinburgh, and nominated by the late Astronomical Institution, and five unofficial members appointed by the Government. Professor J. D. Forbes has been chosen President, and Professor the Rev. P. Kelland, Secretary. So officered, the new Board cannot fail to perform the duties intrusted to it in an efficient manner, to the advantage of science and to the satisfaction of the public.

The annual visitations are to be held in the month of April, in each year; but an extraordinary one took place last December, a few days after the constitution of the Board.

A printed Report, furnished by the Astronomer to the members on that occasion, describes the buildings as having been put into the excellent condition above described, and mentions that a number of small alterations and improvements had been effected

upon the transit instrument and mural circle; and that observations were beginning again, at the same time that the old work is being brought up. The calculations of 1842 are completed and nearly printed, and those of 1843 commenced.

The distribution of the printed volumes to foreign observatories and societies is mentioned as a difficult and uncertain task; but the services of the Assistant Secretary of the Royal Astronomical Society in expediting and facilitating the transit of such parcels, are thankfully acknowledged.

The Liverpool Observatory has frequently been mentioned in our *Notices*, and its progress described; we have now the pleasure of announcing its complete equipment and full activity. As we may fairly expect numerous and valuable contributions from this Observatory, which may be proposed as a model for similar institutions, it is proper briefly to recall its history to mind.

The propriety of establishing an observatory to give true time at the great port of Liverpool was brought prominently forward when the British Association held its meeting there. The plan of the existing observatory, with its instruments, was furnished by the Astronomer Royal. The site was selected, or approved of, by Messrs. Baily, Smyth, Dollond, Dawes, and Lassell, and the director, Mr. Hartnup, was appointed on the recommendation of the Astronomical Society. We may, perhaps, be allowed to say, that the Liverpool Observatory Committee consulted judicious advisers; the Town Council assuredly has been most liberal in carrying that advice into effect. Let us hope that our other sea-ports may be induced to follow the example of Liverpool, even at a humble distance.

The Observatory, besides a convenient house for the astronomer, contains a transit-room, equatoreal-room with a revolving dome, chronometer-room, and computing-room. The three first adjoin each other. The transit instrument has a telescope of 5-feet focus and 4 inches aperture. It is of the strongest form, made by Messrs. Troughton and Simms, on the plan of the Astronomer Royal. The transit clock is by Molyneux, and so is the mean-time clock, which is in the chronometer-room. The two clocks are so placed that they are compared by coincident beats. The chronometer-room is fitted up for receiving the chronometers which are sent for trial or rating, and contains a stove, heated by gas, for testing the chronometers. So perfect is the arrangement of this stove, that Mr. Hartnup can maintain any required heat, for an unlimited time, within 1° or 2°. It is his habit to try all the chronometers sent to the Observatory in considerable variations of temperature, and to give the rates corresponding to the temperatures with every time-keeper when it is taken away. His experience seems to prove, that the well-known defect in the ordinary compensation is the cause of the largest errors which are now to be found in well-made chronometers, and that, so long as the oil continues good, the rate corresponds to the temperature. It seems probable, that the

chronometer errors in long voyages would be very greatly diminished by using the rates corresponding to the temperatures, and it is hoped that in time this practice may be introduced. It is, however, only at the Liverpool Observatory that such rates can be obtained.

Having these extraordinary facilities for experiment, Mr. Hartnup has contrived a balance to go uniformly at all temperatures, and the trials which he has made seem to shew complete success. These is no doubt as to the ingenuity of the construction, or as to its beneficial effect, so far as it goes. A chronometer on Mr. Hartnup's principle, constructed by Mr. Shepherd, is now on trial at Greenwich, where the value of the invention will be tested. It is, however, so little trouble to read a thermometer daily, and to bring up the chronometer error by the corresponding rate, that intelligent seamen must, before long, fall into the method. If, with such an institution as the Observatory, the shippers and captains of Liverpool go to sea with bad chronometers, wrong errors, or indifferent rates, they have no one to blame but themselves. The Corporation has done its duty.

The Liverpool instrument, which is most interesting to the present meeting is the magnificent equatoreal which has recently been added to the Observatory. This instrument is now mounted, and it appears to satisfy the expectations which were formed by those who had interested themselves in its erection. The object-glass by Merz (8 French inches in aperture and about 12 feet in focal length) is an exceedingly fine one. The polar axis is found to be very firm, and the hour-circle arrangement (in which an hour-circle is kept in motion by clock-work, and the instrument is clamped to it at pleasure, similar to that of the Northumberland equatoreal) is very convenient. But the part of it which exhibits the greatest novelty is the clock-work. The Astronomer Royal, who directed generally the mounting of this instrument, and whose tastes incline him to study the best constructions adopted by engineers, determined to adopt, for the regulation of the clock-work, the principle of the regulator known by engineers under the name of "Sieman's Chronometric Governor," a construction whose invention appears likely to form an era in the history of mechanical regulators. This construction can scarcely be adapted to the regulation of engines moved by weights, but it is applied without difficulty to engines driven by water-power or steam-power. The Astronomer Royal, therefore, adopted water-power for the moving force on the Liverpool clock-work (the water acting in the manner suggested by Messrs. Maudslays and Field, by a Barker's mill, receiving its supply at the bottom of its vertical axis). In the opinion of the Astronomer Royal this motive power is, in any case, superior to that of a weight. In many cases (as at Liverpool) it can be supplied in the ordinary commercial way; in other cases, the same body of water may be used over and over again, the winding up of the clock being effected by the operation of pumping the water back, a construction which requires no going-fusee.

For the Sieman's regulator, however, water (or something which may be cut off by degrees) is necessary; and one of the remarkable effects of that contrivance is, that there is consumed exactly as much of the water as (under the varying circumstances of friction and other mechanical resistance) may be necessary, and no more. For instance, if a heavier resistance be applied, the speed of the clock is not altered either theoretically or practically in the smallest degree, but the clock spontaneously adjusts the water-valve, so as to permit a greater flow of water exactly to the amount required to overcome that greater resistance. The application of this principle at Liverpool appears perfectly successful. In the application of it to similar instruments, it may be desirable to diminish the massiveness of some of the moving parts, in the construction of which the engineer has hardly remembered that he was regulating, not a steam-engine, but an astronomical instrument: the only injurious effect, however, of this massiveness is to make the instrument somewhat less sensitive to changes of force than it ought to be. In use the polar axis is so stiff, and suffers so little change of form, that the declination-circle can be used to measure moderate distances as safely out of the meridian as in it. As this circle is 4 feet in diameter, divided on the same engine as the Greenwich altitude and azimuth instrument, and read off by two microscopes, the accuracy of such differential measures approaches very nearly that of our best meridian instruments; and the stars of comparison can generally be selected from a standard catalogue. The observations of Petersen's second comet seem to justify very high expectations from the Liverpool equatoreal.

Mr. Hartnup has been urged to supply the place of Greenwich in observing the faint planets until the new meridian-circle is erected, and afterwards to observe them when they pass the meridian in daylight. This is, undoubtedly, one of the most difficult and laborious departments in practical astronomy, but it is most wanted. Mr. Hartnup would thus relieve Professor Challis, who is too much occupied to continue this class of observations much longer, and he would have the honour of completing a void in the observations of our National Observatory. Such a line may well satisfy the most ambitious observer.

A short account of the Liverpool Observatory has recently been drawn up by Mr. Hartnup for the information of the Observatory Committee, and has been printed by their direction.

As the transit and equatoreal retain their adjustments satisfactorily, the foundation of the Observatory is shewn to be sufficient.

The Council have awarded the Medal to Mr. Lassell of Liverpool, for his excellent construction of an observatory and its instruments, and the discoveries made with them. The President will, as usual, justify this award at the close of the meeting. Mr. Lassell is one of those men of business of whom this country can boast more than any other, who, in spite of the cares of superintending commercial or manufacturing enterprises, can

find time and energy to devote to the advancement of knowledge by their own outlay and personal efforts, and who can produce such results as are generally considered to be only attainable by help of the purse of a nation or a sovereign.

The Council have had, during the past year, to thank more than one of the Fellows for instructive lectures in aid of the interest of the ordinary meetings. To Sir John Lubbock, for his account of his planetary methods, and to the Astronomer Royal, for his account of the methods of Lord Rosse and Mr. Lassell in the construction of their reflecting telescopes, such thanks are most worthily due. The Astronomer Royal has presented to the Society the interesting models which illustrated his account, and the substance of his lecture will be published in the next number of the *Monthly Notices*. The Council always remember that the routine of the ordinary meetings involves details which are not attractive, but to which attention is necessary, and they are glad when an opportunity offers which, without diverting attention from the Society's sole object, the encouragement and promotion of astronomy, enables them to introduce variety into the usual proceedings.

We have had many occasions to express our obligations to Mr. Bishop, and to Mr. Hind, the Director of the South Villa Observatory, for the various services which they have rendered to astronomy, and particularly to this Society. We must here give our thanks to Mr. Bishop for the publication of his Zodiacal Chart, one Number of which, Hour I. to II., has already appeared. It is clearly engraved, on a bold scale, and contains all stars within 3° of the zodiac to the 10th magnitude, inclusive. In the explanatory memoir accompanying the chart, Mr. Bishop promises an early continuation. The Society will regret to hear that Mr. Hind is now suffering from his exposure to cold and over-zeal in computation; but it is hoped that his health may soon be re-established.

The progress made in restoring the Standard Yard, and in constructing verified and exact copies, has not gone on quite so successfully or rapidly as might have been expected. Some months ago, Mr. Sheepshanks reported to the Standard Committee that he had compared a brass bar with all those yards which were compared *originally* with the lost imperial standard, and which are not *known* to have suffered sensible change meanwhile. These gave a fair approximation to the length of the lost standard, quite as near as could be expected. There are several minor difficulties in getting a perfectly satisfactory value of the old yard, some of which may, perhaps, be partially got over by a second and more careful reduction of the original observations made by Messrs. Murphy, Baily, Donkin, &c. in 1834; but the truth is, that the length of the lost standard differed according to each observer, and probably would be estimated of a different length as viewed in reversed positions. The problem, therefore, is a somewhat indefinite one,

and in reality possesses very little interest; for the old standard is not *directly* connected with any exact linear measurement. The Astronomical Society's scale, on which so much good work was employed, clearly altered its state between 1834 and 1844, when it was remeasured by Mr. Baily, shortly before his death, and so cannot serve for this investigation.

The more interesting problem is that of *preserving* the new standard, and getting *facsimile copies* of it, when it is decided upon; and though most of the anticipated difficulties have been overcome, there are still some anomalies remaining, the cause of which is suspected but not yet thoroughly proved. The mode of making the comparisons between any two bars will be best understood by inspecting the apparatus. The process is very easy, and it seems certain that the effects of temperature are not to be feared. The perplexity which still remains is of the following nature. The comparisons in one set of observations agree very well, and, in general, the means of several sets taken at the same time; yet there may be a considerable discrepancy between these and the comparisons of another day. Some very recent observations seem to shew that this is, or may be, caused by an alteration in the light; but this is not very certain, nor is it very obvious how such a cause of error is to be eliminated without an *immense* number of observations. If, however, this stumbling-block can be removed, there seems no other obstacle to a satisfactory solution of the problem, though there is a good deal of disagreeable work to go through.

Mr. Sheepshanks has been necessarily compelled to pay a good deal of attention to the instrument for measuring heat — the mercurial thermometer, and he conceives that he is now able to correct the graduation almost as accurately as can be wished. Probably a communication on this subject may be laid before the Society, as the thermometer is an important astronomical instrument from its connexion with refraction. Though the measuring apparatus is not quite complete, it is so nearly so as to give a good idea of the kind of research now prosecuting in the cellars of the Society's apartments; and it will be shewn to any fellow who is interested in the subject. It is, indeed, very desirable that other persons should now take a share in the operations, which are of the simplest kind, but which require to be repeated by various eyes and hands before a precise judgment can be formed of their accuracy.

Within a very short time, copies have been received in this country of the "*Récherches sur la Parallaxe des Etoiles fixes*, par C. A. F. Peters," extracted from the *Memoirs of the Petersburg Academy*. This is the work to which (then in preparation for the press) allusion was made by M. Struve in his *Etudes*, and upon the conclusions of which M. Struve's numerical deductions for the distances of the fixed stars were founded. As a complete work, exhibiting and criticising every original investigation on the parallax of the stars that has been published up to the present time, and as

communicating the discussion, in the most elaborate form, of the observations made with modern instruments, probably the best in the world, this work must be regarded as one of very great value. The first part of it is devoted to an examination of what had been done up to the year 1842, beginning with Copernicus, Rothmann, and Tycho; reducing anew some observations of Flamsteed and Bradley, omitting none of the writers of the last and the present century, criticising boldly the instruments, the instrumental methods, the computations, and the results of Brinkley, Pond, and others, and then proceeding to the researches more peculiarly belonging to the writer's province. The stars personally examined by M. Peters are eight in number: *α Ursæ Minoris*, *α Aurigæ*, *ι Ursæ Majoris*, *Arcturus*, *α Lyræ*, *α Cygni*, 61 *Cygni*, *Groombridge* 1830. It would be extremely difficult, in a communication of moderate length, to give an idea of the amount and the variety of labour which the writer has employed to correct his results for every conceivable error, whether in the divisions of his circle (the great vertical circle by Ertel), the micrometer screws, the levels, &c., or in the coefficients of formulæ for refraction, temperature correction, aberration, nutation, or proper motion. Of *α Ursæ Minoris* about 280 observations are used; of each of the other stars, a number varying from 40 to 90. The largest parallax which he finds is that of *Groombridge* 1830, about $\frac{3}{9}$ of a second. M. Peters then discusses the parallaxes of 35 stars, which had been treated by other observers; namely, 29 by M. Struve, and 6 by Bessel, Lindenau, &c. He treats these stars, not singly, but as a group, the proportion of their distances being assumed to be that given by the investigations of the *Etudes;* and thus, assuming a symbol to represent the average parallax of a star of the second magnitude, the parallax of every star may be expressed in terms of that symbol, and the whole of the results may be grouped together to form one grand equation with a single unknown quantity. It is thus that M. Peters arrives at the conclusion that the mean or average annual parallax of a star of the second magnitude is about $\frac{1}{9}$ of a second. Probably no work that has appeared for several years past can be put in competition with this, as an instance of well-directed labour, based on the most delicate observations, and employed for one of the greatest objects of sidereal astronomy.

The political disturbances which have lately occurred throughout Europe have not been without effect upon astronomy. The Observatory of the Collegio Romano is closed, perhaps dismantled. But the apprehension of astronomers has been chiefly excited by the position of Professor Schumacher, who appears to be compromised by the Schleswig-Holstein dispute. No one would willingly suppose that the King of Denmark or the authorities of the Duchies would intentionally injure or disturb a man who has done so much honour to both. For nearly thirty years Professor Schumacher, by the *Astronomische Nachrichten*, by his immense correspondence, and by his numerous publications, has made Altona the centre of astronomical information, and given a cosmopolitan

character to the science. The liberality of former sovereigns has placed in his charge a magnificent collection of instruments, which, in his keeping, are really at the service of civilised Europe. He is Director of the Altona Observatory, to which we this year owe the discovery of two comets, all that have been discovered. If, indeed, we were to attempt to particularise the services which the Professor has rendered to astronomy, or even those which he has especially conferred on our own nation, we should have a very long list to set forth. His residence at Altona, adjoining the great mart of Hamburgh, in the great thoroughfare between Germany and the world west of it, has essentially contributed to his usefulness; in any other position, he could not effectually have executed his mission. What your Council apprehended was, that the propriety of leaving the Professor absolutely undisturbed, might not appear so obvious to the commissioners for effecting a reconciliation between the kingdom and the duchies, as it is to astronomers. Your Council, therefore, has taken the unusual step of requesting Lord Palmerston, if he can find a proper opportunity, to plead in the Professor's behalf. We all, as cultivators of astronomy, have lasting obligations to the Professor, and feel that any interruption of his avocations will be felt as a most grievous blow wherever an astronomer or an observatory is to be found. Let us hope that, as great pecuniary interests or questions touching national honour are not involved, the contending parties will acquiesce in the unanimous prayer of so many persons, and allow our excellent associate to finish his exemplary course in all honour and tranquillity.

Titles of Papers read before the Society between February 1848 *and February* 1849.

1848.

Mar. 10. Elements of *Neptune*. Mr. S. C. Walker.
Note on the Satellites of *Uranus*. M. O. Struve.
Elements of *Flora*. Mr. Graham.
Notice of Double Stars. Rev. W. R. Dawes.
Observations of *Flora*. Lieut. Maury.
Ephemeris of *Flora*. Mr. Hind.
Observations of Planets made at the Observatory, Durham. Professor Chevallier.
Ephemeris of *Flora*. M. Brunnow.
Observations of newly discovered Planets. M. Rümker.
Observations of *Iris*. Mr. Cooper.
MS. Collection of Observations of Solar Spots. Rev. Dr. Hussey.
On Planetary Motions. Mr. Davison.
Observations of *Flora*. Sir Thomas Brisbane.

Annular Eclipse of the Sun, Oct. 9, 1847. Major Lysaght.
On the Inner Satellites of *Uranus*. Rev. W. H. Dawes.
Observations of Mauvais' Comet. Professor Challis.
On the Level Errors of the Greenwich and Cambridge Transits. Mr. Henry.
On Binocular Telescopes. Mr. Vallack.
Measures of Southern Double Stars, &c. Captain Jacob.
Observations of Moon and Moon-culminating Stars. Mr. Dell.

April 14. On a remarkable Appearance during the Lunar Eclipse, March 19, 1848. Dr. Forster.
On a remarkable Appearance during the Lunar Eclipse, March 19, 1848. Mr. Walkey.
Observations of Mauvais' Comet, &c. Mr. W. C. Bond.
On the Satellites of *Uranus*, &c. M. O. Struve.
On Engraving primary Information on Seamen's Watches. Mr. Drach.
On a Parhelion seen near Oxford, March 29, 1848. Rev. J. Slatter.
Observations of Mauvais' Comet. Mr. Lassell.
Observations of small Planets. Professor Challis.
Elements of *Flora*. Mr. Boreham.

May 12. Observations of *Iris*. Dr. Kaiser.
Notice of Discovery of a New Planet. Mr. Graham.
Errors in Lalande and Groombridge's Catalogues. M. Faye.
Observations of small Planets, &c. M. Rümker.
Notice of Discovery of a New Star in *Ophiuchus*. Mr. Hind.
Observations of Moon-culminating Stars. M. Jahn.
On the Longitude of Poona. Mr. H. Breen, jun.
Observations of Mr. Graham's Planet. M. Rümker.
Observations of *Metis* at Hartwell. Mr. Hind.
On a new Formula for reducing Observations of Circumpolar Stars, &c. Captain Shortrede.
Double Stars measured at Poona. Captain Jacob.
On a regulated Time Ball. Professor Chevallier.
On a regulated Time Ball and Observations for finding the Latitude by means of a Portable Transit Instrument. Professor Chevallier.
Three Letters to Sir J. Herschel, respecting the New Star in *Ophiuchus*. Mr. Hind.
Extract of Letter to Mr. Hind respecting the New Planet. Mr. Graham.
On the New Star in *Ophiuchus*. M. Petersen.

June 9. Observations of *Metis*. Professor Chevallier.
Observations of *Metis* and Hind's New Star. M. Petersen.
Observations of *Metis*. Professor Chevallier.
Observations of *Flora*. Professor Chevallier.
First Elements of *Metis*. Mr. Graham.

Ephemeris of *Metis*. Mr. Hind.

On a Method of approximating to the distance of a Planet from the Sun by means of two observations only, made near the Planet's Opposition. Professor Chevallier.

Eclipses of *Jupiter's* First Satellite, &c. observed at Charlotte Town, Prince Edward's Island. Captain Bayfield.

On the Lunar Eclipse of May 19, 1848. Rev. C. Mayne.

Corrections of the Elements of the Moon's Orbit, deduced from the Lunar Observations made at the Royal Observatory of Greenwich, from 1750 to 1830. The Astronomer Royal.

Notice of N. Kratzer, Horologier to Henry VIII. Colonel Batty.

Letter accompanying the Portrait of Captain Middleton, Founder of the Mathematical Society. Dr. Lee.

On the Planet *Neptune*. Messrs. Walker and Pierce.

On the State of the Edinburgh Observatory. Professor C. P. Smyth.

On the Latitude of Dera, and the Attraction of the Himalayas. Captain Shortrede.

On a Method of finding the Error and Rate of a Chronometer, from the observed Transits of Three Stars near the Meridian. Captain Shortrede.

On the Difference of Longitude between Paramatta and Port M'Quarrie. Captain Stanley.

On the figure of a Constellation on an ancient Punic Monument. M. Honegger.

On the Great Comet of 1843. Mr. Webb.

Nov. 10. Various Observations, &c. M. Rümker.

Notice of Ephemerides required shortly. Mr. Hind.

Encke's Comet with Ephemeris. Mr. Hind.

On *Iris* with an Ephemeris. Mr. Hind.

Elements of the Comet of 1847. Mr. Pogson.

Observations of *Flora* and *Metis*. Professor Challis.

Ephemeris of *Neptune*. Mr. Adams.

Ephemeris of *Metis*. Mr. Graham.

Observations of *Metis*. Mr. Graham.

Observations of *Flora*. Mr. Graham.

Notice of Errata. Mr. Woollgar.

Mean Places of Stars compared with Mauvais' Comet. Mr. Maclear.

Announcement of the Discovery of Petersen's Comet, Aug. 7, 1848, with Observations. Professor Schumacher.

On various Subjects, and Observations of Encke's Comet. Mr. Hind.

Observations of *Flora*. Messrs. Broun and Welsh.

Parallel between A. S. Catalogue and B. A. Catalogue. Mr. Woollgar.

Observations of *Neptune*. Mr. Thompson.
Observations of *Neptune* and smaller Planets. Professor Challis.
Discovery of an Eighth Satellite of *Saturn*. Mr. Lassell.
Observations, &c. M. Rümker.
Account of Star-sweeps for Maps, &c. at Markree. Mr. Cooper.
Observations of Solar Spot, &c. Rev. A. Weld.
Letter to Mr. Hind. Professor Colla.
Observations of Encke's Comet. Professor C. P. Smyth.
Various Observations. M. Rümker.
On Determining the Intervals between Transit Wires, &c. Mr. Drew.
Observations, &c. M. Rümker.
On Epicyclical Curves. Mr. Drach.
Observations of Mauvais' Comet, &c. Mr. W. C. Bond.
On the Discovery of the Eighth Satellite of *Saturn*. Hon. E. Everett.
On the Discovery of the Eighth Satellite of *Saturn*. Mr. W. C. Bond.
Observations of Petersen's Comet. M. Rümker.
Announcement of the Discovery of Petersen's Second Comet, with Observations. Professor Schumacher.
On a New Theory of Physical Astronomy. Mr. Best.
On the Transit of *Mercury*, Nov. 9, 1848. Mr. Riddle.
Corrections of the Elements of the Orbit of *Venus*. Mr. H. Breen, jun.
Elements of Petersen's New Comet. M. Rümker.
On the Observatory at Cambridge, U. S. Hon. E. Everett.
On the Discovery of the Eighth Satellite of *Saturn*. Mr. Lassell.
On an Expedition for ascertaining the Parallax of *Venus*, &c. Lieut. Gilliss.

Dec. 8. Various Observations. M. Encke, Mr. Cooper, &c.
Observation of Petersen's Second Comet. Professor Schumacher.
Elements of Petersen's Second Comet. M. Rümker.
Account of the Transit of *Mercury*. Dr. Forster.
Two Communications on Petersen's Second Comet. Professor Schumacher.
Occultations observed at Ashurst. Mr. Snow.
On the Figure of the Earth. Mr. Rowbotham.
Observations of the Transit of *Mercury*. Mr. Dell.
Observations of the Transit of *Mercury*. Rev. J. B. Reade.
On the Variability of λ *Tauri*. Mr. Baxendell.
Observations of *Flora*. M. Rümker.
Observations of the Moon and Moon-culminating Stars. M. Rümker.
On a Machine for polishing Specula. Mr. Lassell.

Description of the Liverpool Equatoreal and Observations. Mr. Hartnup.
Observations of Transit of *Mercury*. Mr. Lassell.
Observations of Transit of *Mercury*. Professor Challis.
Observations of Transit of *Mercury*. Mr. Snow.
On a Mode of Observing with the Northumberland Equatoreal and of reducing the Observations. Professor Challis.
Observations of Petersen's Second Comet. Professor Challis.
Observations of *Neptune*. Mr. Hartnup.
Observation of the Transit of *Mercury*. Rev. W. R. Dawes.

1849.
Jan. 12. Elements of Petersen's Second Comet. Mr. Pogson.
On the Chronology of Lunations. Dr. Forster.
On finding the place of a Ship by a single Altitude. Captain Leighton.
Diagram of the Transit of *Mercury*. Rev. J. B. Reade.
Observations of Petersen's Second Comet. Mr. Boreham.
Observations of Petersen's Second Comet. Mr. W. C. Bond.
Ephemeris of *Iris*. Mr. Hind.
On the Transit of *Mercury*. Mr. Hartnup.
On that part of the Equation of Time which depends on the Obliquity of the Ecliptic. Mr. J. Riddle.
Observations of *Hebe* and of Petersen's Second Comet. M. Rümker.
Ephemeris of *Metis*. Mr. Graham.
Observations of *Neptune* and *Iris*. Mr. Hartnup.
Observations of Petersen's Comet. Mr. Hartnup.
Observation of the Transit of *Mercury*. Professor Chevallier.

List of Public Institutions and of Persons who have contributed to the Society's Library, &c. since the last Anniversary.

Royal Society of London.
Royal Society of Edinburgh.
Royal Irish Academy.
Hon. East India Company.
Hon. Board of Ordnance.
Royal Geographical Society.
Geological Society.
Royal Asiatic Society.
Zoological Society.

The Radcliffe Trustees.
The Registrar-General.
Manchester Literary and Philosophical Society.
L'Académie Royale des Sciences de l'Institut de France.
La Société de Physique et d'Histoire Naturelle de Genève.
Royal Academy of Munich.
Royal Academy of Berlin.
Royal Society of Sciences at Göttingen.
The Silesian Society.
Italian Society.
L'Administration Impériale des Mines de Russie.
Depôt de la Marine.
Bureau des Longitudes.
American Philosophical Society.
American Academy of Arts and Sciences.
British Association.
Royal Academy at Brussels.
Royal Observatory at Edinburgh.
The Observatory at Cambridge.
The Observatory at Königsberg.
Academy of Sciences at Naples.
Secretary of the American Survey.
The Editor of the Athenæum Journal.

G. B. Airy, Esq.
Professor A. D. Bache.
C. E. Bernard, Esq.
M. J. B. Biot.
George Bishop, Esq.
Dr. Von Boguslawski.
Mrs. Borron.
George Coleman, Esq.
M. D'Aussy.
Professor De Morgan.
Dr. J. G. Flügel.
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Captain King.
Dr. Lee.
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Professor Plantamour.
W. Pole, Esq.
Professor Quetelet.
Dr Robinson.
Dr. Rutherford.
Professor Schumacher.
Rev. R. Sheepshanks.
Capt. W. H. Smyth, R.N.
Professor C. P. Smyth.
Mrs. Somerville.
Charles Stokes, Esq.
Lieut. Stratford, R.N.
M. F. G. W. Struve.
R. Taylor, Esq.
B. L. Vulliamy, Esq.
Dr. Wichman.
J. W. Woollgar, Esq.

Address delivered by the President (Sir J. F. W. Herschel, Bart.) on presenting the Honorary Medal of the Society to William Lassell, Esq., of Liverpool.

Gentlemen,—The Report of the Council having been read, in which the astronomical discoveries of the year, and especially that of the planet *Metis*, have been clearly and eloquently commemorated, it is now my pleasing duty to state to you the grounds on which it has been agreed by us to award the gold medal of the Society for this year to Mr. Lassell. And this duty, pleasing in itself, I execute with the greater satisfaction, because I have a sort of hereditary fellow-feeling with Mr. Lassell, seeing that he belongs to that class of observers who have created their own instrumental means—who have felt their own wants, and supplied them in their own way. I believe that this greatly enhances the pleasure of observing, especially when accompanied by discovery, and gives a double interest in the observer's eyes, and perhaps, too, in some degree, an increased one in those of the public, to every accession to the stock of our knowledge which his instruments have been the means of revealing: upon the same principle that the fruit which a man grows in his own garden, cultivated with his own hands, is enjoyed with a far higher zest than what he purchases in the market. Nor is this feeling by any means a selfish one. It arises from the natural and healthy excitement of successful exertion, and is part of that happy system of compensation by which Providence sweetens effort, and honours well-directed labour. If this be true of the labour of a man's hands in the mere production of material and perishable objects, it is so in a far superior sense, when the faculties of the intellect are called into exercise, and works elaborated with rare skill, and wrought to an extraordinary pitch of perfection, have yet a higher, ulterior, intellectual object, to which their existence is subordinate, as means to an end.

Mr. Lassell has long been advantageously known to us as an ardent lover of astronomy, and as a diligent and exact observer, in which capacity he has appeared before us, as a reference to our *Memoirs* and *Notices* will testify, on numerous other occasions besides those to which I shall more particularly call your attention presently. In the year 1840 he erected an observatory at his residence near Liverpool, bearing the appropriate name of Starfield, which has ever since been the scene of his astronomical labours. Even at its first erection this observatory presented features of novelty and interest. In addition to a good transit it was furnished, instead of a meridian instrument or an ordinary equatorial achromatic, with a Newtonian reflecting telescope of 9 inches aperture, and rather more than 9 feet in focal length, equatorially mounted, the specula of which were of his own construction, and the mode

of mounting devised by himself. This was already a considerable step, and forms an epoch in the history of the astronomical use of the reflecting telescope. Those only who have had experience of the annoyance of having to keep an object long in view, especially under high magnifying powers, and in micrometrical measurements, with a reflector mounted in the usual manner, having merely an altitude and azimuth motion, can duly feel and appreciate the advantage thus gained. But the difficulties to be surmounted in the execution of such a mode of mounting were very considerable—much more so than in the case of an achromatic,—owing partly to the non-coincidence of the centre of gravity of the telescope and mirror with the middle of the length of the tube, and partly to the necessity of supporting the mirror itself within the tube in a uniform bearing free from lateral constraint, and guaranteed against flexure and disturbance of its adjustment by alteration of its bearings. These difficulties, however, Mr. Lassell overcame: the latter, which is the most formidable, by an ingenious adaptation of the balancing principle first devised, if I am not mistaken, by Fraunhofer and Reichenbach for the prevention of flexure in the tubes of telescopes —a principle which has not received half the applications of which it is susceptible, and which, by throwing the whole strain of the weight of instruments on axes which may be made of unlimited strength, may be employed to destroy the distorting force of gravity on every other part.*

The success of this experiment was such, and the instrument was found to work so well, that Mr. Lassell conceived the bold idea of constructing a reflector of 2 feet in aperture and 20 feet in focal length, and mounting it upon the same principle. The circumstances of his local situation, in the centre of manufacturing industry and mechanical construction, were eminently favourable to the success of this undertaking; and in Mr. Nasmyth he was fortunate enough to find a mechanist capable of executing in the highest perfection all his conceptions, and prepared, by his own love of astronomy and practical acquaintance with astronomical observation and with the construction of specula, to give them their full effect. It was of course, however, the construction and polishing of the large reflector which constituted the chief difficulty of this enterprise. To ensure success, Mr. Lassell spared neither pains nor cost. As a preliminary step, he informs us that he visited the Earl of Rosse, at Birr Castle, and besides being favoured with more than one opportunity of satisfying himself of the excellent performance of that nobleman's 3-foot telescope, enjoyed the high privilege of examining the whole machinery for grinding and polishing the large speculum, and returned so well satisfied as to resolve on the immediate execution of his own ideas.

The mode of casting and grinding the mirror, differing in some

* As, for example, the divided limbs of circles, and the spokes connecting them with their centres; an easy and simple mechanism, which, devised some time ago, and approved by the late M. Bessel, I may, perhaps, take some future opportunity to submit to the Society.—(*Note added in the Printing*).

of the details, though proceeding generally on the same principle as Lord Rosse's (*i. e.* by a chilled casting), has been described in a communication read to this Society on the 8th of December last. The polishing was performed on a machine almost precisely similar to that of his lordship. But finding after many months' trial that he could not succeed in obtaining a satisfactory figure, he was led to contrive a machine for imitating as closely as possible those evolutions of the hand by which he had been accustomed to produce perfect surfaces on smaller specula. This machine has been described (and a model of it, as well as Mr. Nasmyth's finished working drawings of it, exhibited) in the paper to which I have already referred, of which an abstract has been printed in our *Notices*, and must by this time be in the hands of every fellow here present, so that it cannot be necessary for me to recapitulate its contents. Suffice it to say that I have carefully examined both the drawings and the model, and having myself had some experience in the working and polishing of reflecting specula, approaching (though inferior) in magnitude to Mr. Lassell's, I am enabled to say that the machine seems to unite every requisite for obtaining a perfect command over the figure; and when executed with that finish which belongs to every work of Mr. Nasmyth, from the steam-hammer down to the most delicate product of engineering and mechanical skill, cannot fail to secure, by the oily smoothness and equability of its movements, the ultimate perfection of polish, and the most complete absence of local irregularities of surface. The only part which I do not quite like about it, or perhaps I should rather say which seems open to an *à priori* objection, refutable, and, in point of fact, refuted by the practical results of its operation, is the wooden polisher, owing to the possibility of warping should moisture penetrate the coating of pitch with which it is (I presume) enveloped on every side. Some unhygrometric, non-metallic substance, such as for instance earthenware, porcelain biscuit, or slate, would be free from this objection, though possibly open to others of more importance.

Both Mr. Lassell and Lord Rosse appear to be fully aware of the vital importance of supporting the metal, not only while in use, but also during the process of polishing, in a perfectly free and equable manner; but the former has adopted a mode of securing a free bearing on the supports, by suspending the mirror, which is a great and manifest improvement on the old practice of allowing it to rest on its lower edge, by which not only is the figure necessarily injured by direct pressure, but the metal is prevented from playing freely to and fro, and taking a fair bearing on its bed. As I have, however, on another occasion enlarged on the necessity of making provision against these evils, by a mechanism almost identical in principle, I need not dwell upon this point further than to recommend it to the particular attention of all who may engage in similar undertakings.

It is right that I should now say something of the performance of the 9-inch and 2-feet reflectors. And first, as regards the suc-

cess of the system of mounting adopted in securing the peculiar advantages of the equatorial movement. This appears to have been very complete. The measurements, both differential and micrometrical, made with them, and recorded in our *Notices*, shew that in this respect they may be considered on a par with refractors, and in facility of setting and handling they appear no wise inferior. Of the optical power of the former instrument, two facts will enable the meeting to form a sufficient judgment. With this Mr. Lassell, independently and without previous knowledge of its existence, detected the sixth star of the trapezium of θ *Orionis*. And with this, under a magnifying power of 450, and in very unfavourable circumstances of altitude, both himself and Mr. Dawes became satisfied of the division of the exterior ring of *Saturn* into two distinct annuli, a perfectly clear and satisfactory view of the division being obtained.

The feats performed by the larger instrument have been much more remarkable and important. It has established the existence of at least one of the four satellites of *Uranus*, which since their announcement by Sir W. Herschel had been seen by no other observer, viz. the innermost of all the series, and afforded strong presumptive evidence of the reality of another, intermediate between the most conspicuous ones. The observations of M. Otto Struve, if they really refer to the same satellite, are of nearly a month later date.

To Mr. Lassell's observations with this telescope we also owe the discovery of a satellite of *Neptune*. The first occasion on which this body was seen was on the 10th of October, 1846, but owing to the then rapid approach of the planet to the end of its visibility for the season, it could not be satisfactorily followed, until the next year, when, on the 8th and 9th of July, observations decisive as to its reality as a satellite were made, and in August and September full confirmation was obtained. This important discovery has since been verified both in Russia and in America. I call it so, because, in fact, the mass of *Neptune* is a point of such moment, that it is difficult to overrate the value of any means of definitively settling it. Unfortunately, the exact measurement of the satellite's distance from the planet is of such extreme difficulty, that, up to the present time, astronomers are still considerably at issue as to the result.

I come now to the most remarkable of Mr. Lassell's discoveries, one of the most remarkable, indeed, as an insulated fact, which has occurred in modern astronomy; though, indeed, it can hardly be regarded as an insulated fact, when considered in all its relations. I need hardly say that I allude to the discovery of an eighth satellite of *Saturn;* a discovery the history of which is in the highest degree creditable, not only to the increased power of the instruments with which observatories are furnished in these latter days of astronomy, but also to the vigilance of observers. If I am right in the principle that discovery consists in the certain knowledge of a new fact or a new truth, a knowledge grounded on positive and tangible evidence, as distinct from bare *suspicion* or *surmise* that such a fact exists, or that such a proposition is true — if I am right in assigning as the moment of discovery, that moment when the disco-

verer is first enabled to say to himself, or to a bystander, "I *am sure* that such is the fact,—and I am sure of it, *for such and such reasons*," reasons subsequently acquiesced in as valid ones when the discovery comes to be known and acknowledged — if, I say, I am right in this principle (and I really can find no better), then I think the discovery of this satellite must be considered to date from the 19th of September last, and to have been made simultaneously, putting difference of longitude out of the question, on both sides of the Atlantic. In speaking thus, I desire, of course, to be understood as expressing only my own private opinion, and in no way as backing that opinion by the authority of the Society whose chair I for the moment occupy. The Astronomical Society receives with equal joy the intelligence of advances made in that science from whatever quarter emanating, and accords the meed of its approbation to diligence, devotion, and talent, with equal readiness wherever it finds them — but declines entering into *nice* questions of personal or national priority, and would, I am sure, emphatically disavow the assumption of any title to lay down authoritative rules for the guidance of men's judgments in such matters. The medal of this day is awarded to Mr. Lassell, not on account of this discovery alone, and as such, but as taken in conjunction with the many other striking proofs he has afforded of successful devotion to our science — both in the improvement and in the use of instruments. And among the motives which have induced your Council to place Professor Bond on the list of our Associates (I trust not long to be the only one of his countrymen by whom that honour is enjoyed), though this discovery has had its due and just weight, we have not been unheedful of his general merits, both as an observer and as a theoretical astronomer — merits of which the *Memoirs* which have recently reached us convey the most abundant evidence in both departments.

I have observed that, when taken in all its relations, the discovery of an eighth satellite of *Saturn* cannot be regarded as quite an insulated fact. Between *Iapetus* and *Titan* there existed a great gap unfilled, in which (as formerly between *Mars* and *Jupiter*) it was not in itself unlikely that some additional member of the Saturnian system might exist. The extreme minuteness of *Hyperion* forcibly recalls the analogous features of the asteroids, and it would be very far from surprising if a further application of the same instrumental powers should carry out this analogy in a plurality of such minute attendants.

Mr. Lassell, as you are all well aware, is bound to astronomy by no other tie than the enjoyment he receives in its pursuit. But in *our* estimation of his position as an Amateur Astronomer it must not be left out of consideration, that his worldly avocations are such as most men consider of an engrossing nature, and which entitle them in their moments of relaxation, as they conceive, to enjoyments of a very different kind from those which call into fresh and energetic exertion all their faculties, intellectual and corporeal. It is no slight and desultory exercise of those faculties which will enable any man to carry into effect so much thoughtful combination, and to avail himself with so much consecutiveness of their

results when produced. And however we may and must acknowledge that such a course of action is really calculated to confer a very high degree of enjoyment and happiness, we ought not to feel the less gratefully towards those who, by their personal example, press forward the advent of that higher phase of civilisation which some fancy they see not indistinctly dawning around them; a civilisation founded on the general and practical recognition of the superiority of the pleasures of mind over those of sense; a civilisation which may dispense with luxury and splendour, but not with the continual and rapid progress of knowledge in science and excellence in art.

I think I should hardly be doing full justice to my subject or to the grounds taken by the Council in the award, if I were to conclude what I have to say otherwise than in the pointed and emphatic words of a Report officially embodying the prominent features of the case. "The simple facts," says that document, "are, that Mr. Lassell cast his own mirror, polished it by machinery of his own contrivance, mounted it equatorially in his own fashion, and placed it in an observatory of his own engineering: that with this instrument he discovered the satellite of *Neptune*, the eighth satellite of *Saturn*, and re-observed the satellites of *Uranus*. A private man, of no large means, in a bad climate" (nothing, I understand, can be much worse), "and with little leisure, he has anticipated, or rivalled, by the work of his own hands, the contrivance of his own brain and the outlay of his own pocket, the magnificent refractors with which the Emperor of Russia and the citizens of Boston have endowed the observatories of Pulkowa and the Western Cambridge."

(*The President then, delivering the Medal to Mr. Lassell, addressed him in the following terms*):—

And now, Mr. Lassell, all that remains for me is to place the medal in your hands, and to congratulate you on your success and on the noble prospect of future discovery which lies before you, now that, free from the preliminary labour of construction, your whole attention can be devoted to using the powerful means you have created. In the examination of the nebulæ, in the measurement of the closest double stars, and the discovery of others which have hitherto defied separation—in the physical examination of the planets and comets of our own system, there is a wide field open and the sure promise of an ample harvest; and I can only add, that we all heartily wish you health and long life to reap it.

The Rev. W. Read, M. A., Summer Place, Broughton, Manchester;
Benjamin Bell, Esq., Jesmond Villas, Newcastle-on-Tyne;
Thomas Weddle, Esq., Wimbledon;
Robert Stephenson, Esq., M.P.; and
Thomas Coventry, Esq., 5 Old Sq., Lincoln's Inn,

were balloted for and duly elected Fellows of the Society.

The Meeting then proceeded to the election of the Council for the ensuing year, when the following Fellows were elected, viz.:

President:

G. B. Airy, Esq. M.A. F.R.S. *Astronomer Royal.*

Vice-Presidents:

John Crouch Adams, Esq. M.A.
Edward Riddle, Esq.
Rev. Richard Sheepshanks, M.A. F.R.S.
Lieut. Wm. Stratford, R.N. F.R.S.

Treasurer:

George Bishop, Esq.

Secretaries:

Augustus De Morgan, Esq
Captain R. H. Manners, R.N.

Foreign Secretary:

John Russell Hind, Esq.

Council:

George Dollond, Esq. F.R.S.
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John Lee, Esq. LL.D. F.R.S.
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Captain W. H. Smyth, R.N. K.S.F. D.C.L. F.R.S.
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London: George Barclay, Castle Street, Leicester Square.